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MCZ newsletter

MUSEUM OF COMPARATIVE ZOOLOGY

Philip J. Darlington, Jr.

MARINE BIOLOGY UPDATE

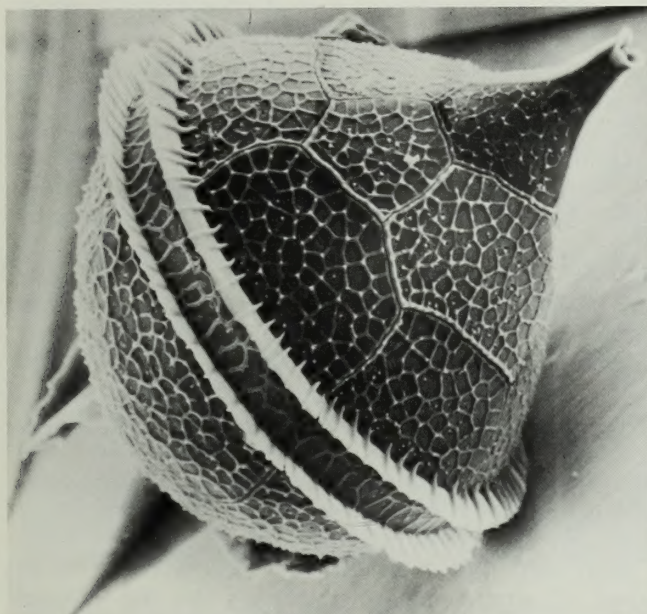


Photo by Alfred and Laurel Loeblich (2630X)

Western Canada red tide organism.

What's going on in marine biology at the MCZ and vicinity these days? A complete answer to this casual question would, perhaps surprisingly, fill volumes. Surprising because while long-term staff members like William Schevill, Kenneth Boss, and Ruth Turner, and, more recently Karel Liem, have long been studying marine life, it is only in the recent past with the addition of several new staff members whose work centers on aquatic organisms that a critical mass of researchers in this area has sprung up. Closer investigation reveals that these scientists (including Robert Woollacott, James McCarthy, Jane Menge, and Alfred and Laurel Loeblich as well as several advanced graduate students) cannot really be considered a group in the sense that their work is centered on various aspects of a single fundamental question, but rather as a loosely-connected assemblage of individuals asking different biological questions and using plants and animals on every level of the vast marine environment to find answers.

James McCarthy is the only researcher who can be considered a true biological oceanographer. He is an

ecologist who is concerned with the forces that regulate productivity of microscopic plants in the ocean — a question fundamental to the maintenance of marine life. There is a popular misconception that the open ocean is a biological desert because there is little observable plant life. However, since all major food chains originate with plants, they must be in the ocean in some form. McCarthy explains that the reason there is so little standing crop of plant life in the ocean is that microscopic nutrients, called phytoplankton, are produced and consumed practically simultaneously. Since plants can only be maintained in the upper sunlit region of the water (which extends no lower than 100 meters) the recycling of nitrogen is vital to the food chain transfers to the organisms living at greater depths.

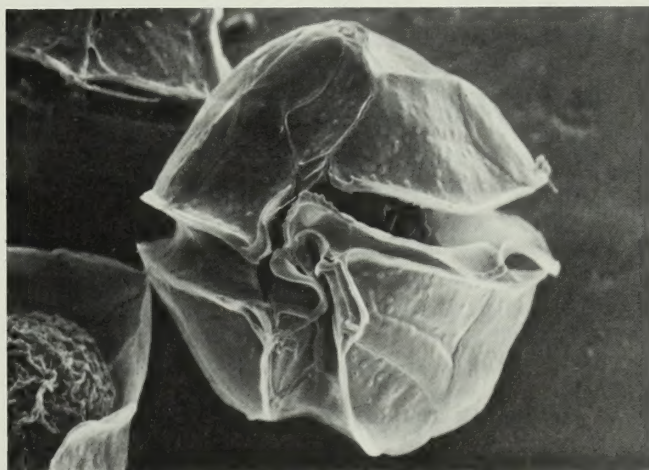


Photo by Alfred and Laurel Loeblich (2014X)

New England red tide organism.

The difficulties encountered in this form of research are obvious; taking samples from the open ocean provides more questions than answers. The immediate history of the sample cannot be known, one can only measure what is happening at the moment. Since the open ocean is a constantly dynamically changing environment, one can only attempt to fit together the sequence of events from the limited evidence available. Basically what happens is that things get eaten before they can be seen. As McCarthy puts it: "The limits of analytical detection are

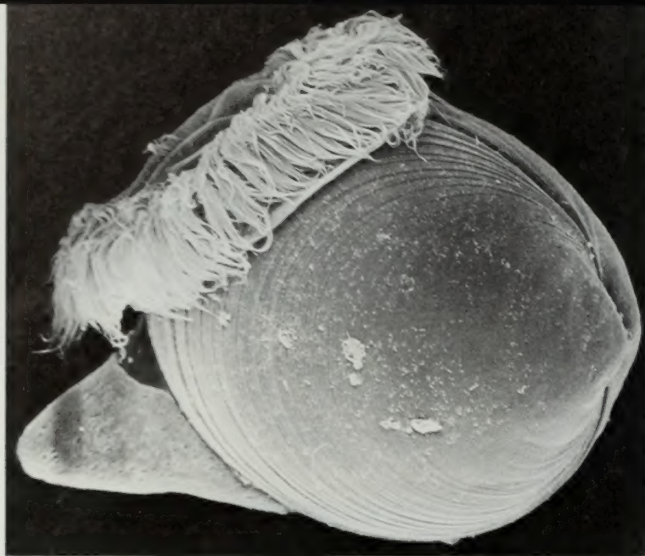


Photo by Ruth Turner (184X)

Side view of a bivalve pediveliger larva.

strained". Since ship time is exorbitant, a high degree of cooperation between scientists is essential. A further factor contributing to the urgency of the situation is that research is governed by daylight.

At present McCarthy is attempting to uncover the reasons for the great biological differences between two bodies of water — the southern Sargasso Sea and the East Caribbean basin. Both areas are hydrographically similar but biologically vastly different. He thinks the answer lies in the relative availability of nitrogen and phosphorus but it is troubling that the various components cannot be named, or that geographic and population studies cannot be undertaken. Despite all these built-in frustrations, McCarthy is continuing to develop techniques to be able to "see" analytically and to improve sampling techniques.

Jane Menge is also an ecologist concerned with the interaction of plants and animals in a marine environment. However, the area she has isolated for her research, the rocky intertidal zone is much more hospitable to the experimental approach. Menge's work is directed towards arriving experimentally at an understanding of how communities function, i.e., how biological factors such as predation or competition affect the distribution, abundance, size or number of species in the community. As she puts it: "We need to understand how natural communities operate in order to evaluate man's effects on them". Her particular bias is the role that herbivores play in the unique intertidal system which alternately exposes its resilient inhabitants to air and water, salt water and rain water, heat and cold. Menge conducts long term experiments by altering the environment studied. She may remove herbivores from the area and study the effect on the remaining plant and animal life or "play" sea urchin and remove patches of seaweeds by sand blasting. While she has mainly concentrated her attention on the relatively simple New England coast, Menge plans to compare the role of herbivores there with that in the intertidal zones of the West Coast and Panama and hopes to find the reasons for the significant differences in numbers of species in different communities.

Other workers in marine biology are concentrating their attention on different marine organisms ranging

from whales (William Schevill) to molluscs (Kenneth Boss) to the unicellular dinoflagellates (Alfred and Laurel Loeblich). Schevill's work on all aspects of the biology of whales and porpoises and his particular concern with underwater sound conduction are well known. Fishes are Karel Liem's research animals. He is particularly interested in their complex adaptations to ecological niches. Kenneth Boss concentrates on the systematics of molluscs and is now following the migration of a species of arctic clam which circles the north pole. Robert Woollocott is interested in the regulation of reproduction in marine animals from the cellular to the population levels. Currently he is investigating the mechanisms controlling synchronous spawning in sea-squirts (ascideans) and patterns of reproduction in moss animals (bryozoans). Ruth Turner is working on a comprehensive key to identify the benthic marine gastropods of the New England coast. This key will be useful to ecologists who need to put a name on the animals they are working with on the study of the feeding habits of fish being carried out by scientists at the Fisheries Laboratory at Wood's Hole. Turner's work on wood-boring bivalves, or shipworms, described in *MCZ Newsletter* (Vol. 4, Number 3) is an example of how pure research can provide practical answers to a severe problem — the destruction of ships, piers, and pilings by shipworms. Alfred and Laurel Loeblich are also engaged in applying their experimental findings to a problem plaguing man — the toxicity of the organism causing New England red tides. Sponsored by a grant from the Massachusetts Science and Technology Foundation, they are trying to produce a non-toxic mutant in the lab.

From this brief overview, it is clear that the broad range of studies being conducted on the myriad aspects of marine life are representative of the diversity and vastness of the ocean itself.

TRIP ROUND-UP

Baja 1977

If you were one of the more than 160 Friends of the MCZ who recently boarded the *Dolphin III* on two

There's more than whales in Baja! Trip leader Steven K. Katona sips the nectar of a blooming agave, or century plant, on Cedros, one of the unforgettable islands on the Baja itinerary.

Photo by Bettina K. Hofmann



successive weekends and saw whales off Provincetown, all that can be said is, if you liked Provincetown, you'll love Baja! This popular trip will be repeated for the fourth time next January with Steven K. Katona again serving as the marine mammal guide, William Haas as general naturalist and star lizard and snake catcher, and Reed Pierce as botanist and bird watcher. Prospective Baja whale watchers are urged to make an early decision since reservations are taken on a first-come, first-served basis and a second trip will not be run next year.

Galapagos 1977

A Friends of the MCZ trip (March 16-29) to the Galapagos Islands aboard the m/v *Iguana* will be led by Robert Silberglied of the MCZ, who has spent more than a year studying the unique fauna of these isolated islands, and Duncan Porter, now of Virginia Polytechnic Institute, author, with Ira M. Wiggins, of the definitive flora of this region. Dr. Porter has served as botanist for two MCZ Baja trips. A complete itinerary and reservation information will be available soon.

CRAIG WOOD FINDS FOSSIL HUNTING EXCELLENT IN ETHIOPIA



Photo by Craig Wood

All these skulls and bones were collected in a half hour at one abundant area the size of a large room.

Craig Wood, who has been in and out of the MCZ's Vertebrate Paleontology Department for the last several years, is back again with an irrepressible smile on his face. The reason for his obvious glee is the satisfying success of a recent (Jan., 1976) reconnaissance trip to Ethiopia. Here on leave of absence from his teaching position at Providence College, Wood is dividing his time between writing up his Ph.D. thesis (on a study of a Paleocene mammal and shark fauna from Wyoming and a general overview of Cretaceous and Paleocene mammal radiations), sorting through lists and reports of the remarkable fossil remains he found, and projecting plans to return to Ethiopia next year.

Ethiopia is transected by the East African Rift Valley which continues up from the Olduvai Gorge area in Tanzania to an intersection with the rifts which form the Red Sea and the Gulf of Aden. This rift "triple junction" is centered in a broad area of lowland in eastern Ethiopia called the Afar Triangle. All the African rift valleys have been the repository of sediments, skeletons, and artifacts during the 10 million year (or more) history of modern man's evolution from

more primitive ancestors throughout all Africa. The Afar area, being possibly central to the forces which have created the rift, contains the most complete record of this history, and for still not understood reasons, the best preserved fossils. It is only in the past four years that the Afar triangle area has been seriously explored by paleontologists and a Case Western Reserve University group has already uncovered more than 150 excellently preserved hominid specimens there, ranging around two to three million years in age. There now are two exploratory groups operating in the region; Wood's group, known as the Rift Valley Research Mission was led by Jon Kalb and consisted of seven people on the last trip. Travel was by Land Rover and accommodations were mattresses on the ground and occasional refuge beneath a mosquito net.

So far the area worked by the RVRM group has yielded skulls and skeletons of elephants, hippos, antelopes, pigs — everything but hominids. However, incredible numbers of hand axes were found lying on the deposits and it is hoped that further exploration might expand our knowledge of man's evolutionary history. Some scientists claim to have been able to trace the origins of *Homo sapiens* back to *Australopithecus*; others feel that man's ancestors were contemporaneous with *Australopithecus* and that his earlier antecedents have yet to be identified. The development of mammals up to the ape-like primates is now well established. What joined these two parts of the story has become the elusive "missing link" which might be uncovered in future fossil hunting trips to Ethiopia.

MYVANWY DICK RETIRES

Myvanwy Dick was toasted and gifted on Thursday, January 29 in recognition of her retirement after thirty years of service to the MCZ. Her contributions to the Fish Department have been legion and were recorded in an article in the *MCZ Newsletter* (Vol. 2, No. 2) upon her appointment as Ichthyologist. Mrs. Dick has just completed documenting the stations visited by Louis Agassiz on the Thayer expedition. She plans to continue her work on the type collection catalog. She is also working on a general guide to the freshwater fishes of New England.

What external factors influence internal responses, and consequently, the behavior, of animals? The intriguing question of how an animal's social and ecological environment stimulates hormonal secretion which, in turn, regulates behavior is being given increased attention by several Harvard scientists. The latest addition to this group is David Crews, an experimental behaviorist, who is using a multidisciplinary approach to examine the reproductive processes in reptiles.

Crews has found that the *Anolis* lizards are the perfect laboratory animal for behavioral-physiological experiments since many are small, readily available, and easy to care for in the laboratory. Since many species retain their complete behavioral repertoire and complex social systems in captivity and since a great deal is already known about the behavior and general ecology of a number of *Anolis* species, Crews is able to relate his results in the lab to his subjects' behavior in their natural environment.

For instance, in a broad investigation of the various stimuli controlling seasonal ovarian growth in *Anolis carolinensis*, a small anole found in the southeastern United States, Crews has found that the dewlap (a brightly colored flap of skin beneath the chin) has important social functions. If a male is prevented surgically from exposing his dewlap, females will not respond to him sexually even though he continues to



Anolis tropidonotus at rest.

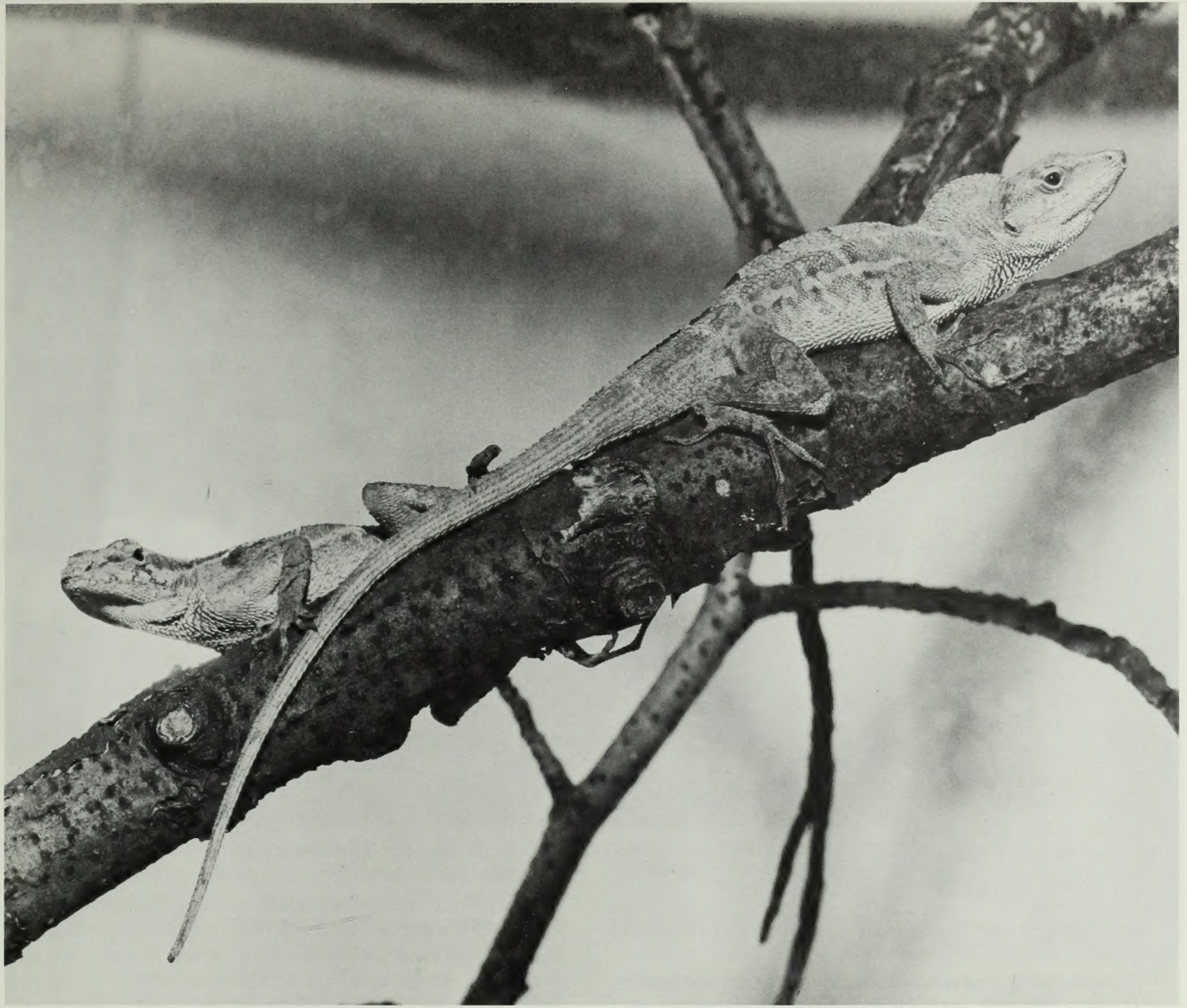
ANSWERS TO BASIC BEHAVIORAL QUESTIONS EMERGING FROM DAVID CREWS' LIZARD LAB



Anolis tropidonotus challenging another male. The extended dewlap is bright red with a black inner spot and yellow border.

perform the other behavior patterns that normally accompany courtship. Thus, an extended dewlap is necessary to elicit the desired response in the female. Since *Anolis* lizards tend to have differently colored dewlaps, Crews attempted to answer the question of what role the color of the dewlap plays by injecting India ink in the region of the dewlap, changing it from the species-typical red to blue. Surprisingly, females continued to respond sexually to these abnormal males. Why does the female not differentiate between a red and blue dewlap and what is the role of the different dewlap colors in nature?

Professor Ernest Williams has suggested that dewlap color serves to reproductively isolate different species of *Anolis* when they share similar niches in the same geographic area. If this is in fact the case, Crews has hypothesized that since *A. carolinensis* is the only anoline in most of the United States (only in Florida is it joined by *A. distichus* and *A. sagrei*) the female has not had to develop a differentiating mechanism. However, in the West Indies, where anoles are numerous, it is probable that species-typical dewlap colors developed as a consequence of interspecific competition. Crews is currently studying the physiological and behavioral effects of courtship in some West Indian *Anolis* species to compare them with his studies of *A. carolinensis*.



Anolis tropidonotus with dorsal and nuchal crest, in aggressive display.

Another striking feature of the hormone-behavior interrelationships in *Anolis carolinensis* is the effect of male-male aggression on the ovarian activity of the female. In the beginning of the breeding season, there is a continuous high level of male-male aggression until territorial boundaries are established; females typically emerge from hibernation soon afterwards and courtship begins upon their arrival on the breeding grounds. This same transition can be duplicated in the laboratory if winter dormant, reproductively inactive males and females are placed in environmental chambers which simulate the Louisiana summers. Under these conditions, testicular growth is very rapid and there is initially a great deal of male-male aggression. Within a short time, however, a single male becomes dominant over the other males and aggression diminishes between the males; the dominant male then begins to court the females. When exposed to this normal transition from predominantly male-male aggression to male courtship by the dominant male, females exhibit normal ovarian activity similar to that seen in wild females. If, however, females are exposed to unstable social conditions in which a dominance hierarchy has not been established, pitu-

itary hormones necessary for insuring normal ovarian activity are not produced and females do not become sexually active, even though they are exposed to climatic conditions that would normally stimulate ovarian recrudescence. Crews has extended this work and shown that different male behaviors are responsible for these effects and that specific male behavior patterns have very specific effects on female reproductive physiology. For example, aggression between males in some way counteracts the stimulatory effects of the environment and prevents ovarian growth while male courtship acts along with environmental stimuli to very rapidly induce egg laying.

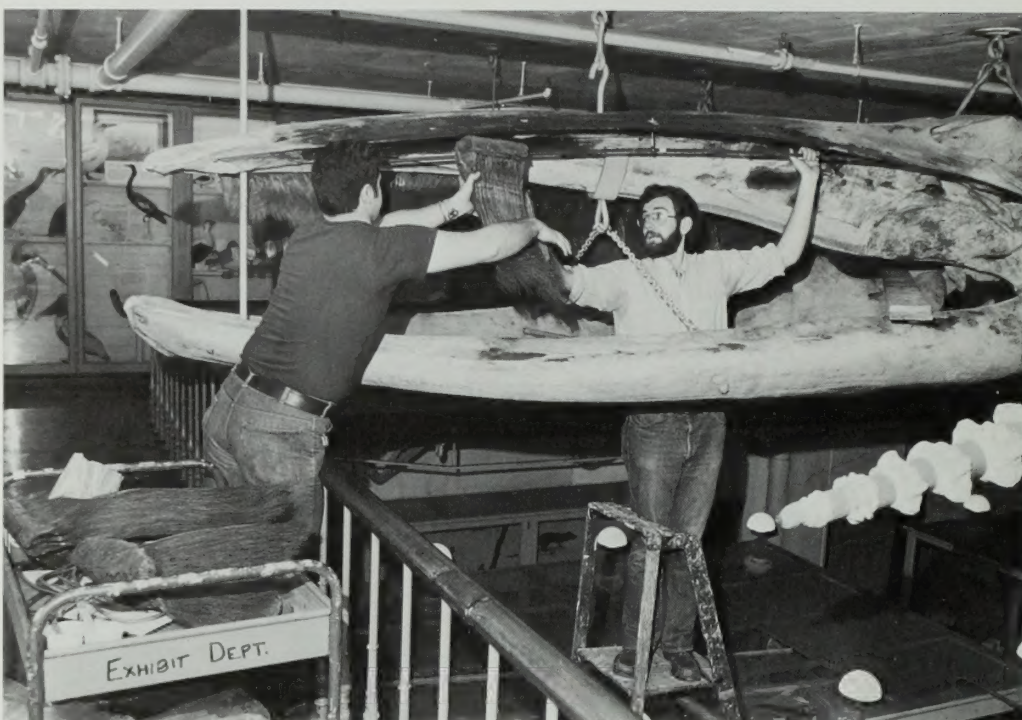
Crews has investigated many other aspects of reproductive behavior in anoles including the effect of male castration on female ovarian response as measured by egg production — when there is normal courtship, the eggs are shelled but when females are exposed to castrated males that do not court, pituitary gonadotropin secretion is subnormal and only unshelled eggs are laid. He has described his results in a recent paper in *Science* (Vol. 189: pp. 1059-1965) entitled *Psychobiology of Reptilian Reproduction*.

WHALE SKELETONS GET FACE-LIFT AND SLIGHT CORRECTIVE SURGERY

If you visit the MCZ's Mammal Hall and look up, you will see the newly-cleaned skeletons of a finback, a right whale and a sperm whale. When the work is completed, you will also be able to get a closer look at the bones, minus their array of carved initials, from the balcony. To the initiate to whale anatomy, there is also a more subtle change. The baleen on the finback whale is now the correct way around after being backwards since the original mounting in 1888! It has long been known that the mounting was not entirely accurate — the person who put the bunch of bones together back in the 1880's did a highly creditable job considering how little was known about whale anatomy in those days.

The present project has included blasting the bones, brushing the grit out of the baleen, painting and cleaning the ceilings, walls, and balcony railings, and refinishing the floor. These renovations have restored the intrinsic charm and elegance of this authentic Victorian museum gallery.

Funds are still being sought to complete this project.



Frank Brosnihan (l.) and Peter O'Connell putting the baleen back the right way around in the finback whale.

A recent unexpected windfall came in the form of two consecutive rainy Sundays. What difference did that make? The Friends of the MCZ were on two whale-watching weekends out of Provincetown, and since bad weather caused the Sunday outings to be canceled, the Friends were entitled to a partial refund. However, many opted to contribute their refund to the whale renovation project. Suggestions for other sources of funds to complete this project will be most welcome!

MCZ BIBLIOPHILES GET THEIR HANDS INTO THE VAT: THE RESULT: PAPER!

On April 3 Friends of the MCZ participated in the 20-centuries-old craft of hand papermaking. Bob Hauser and Helena Wright of the Busyhaus Workshop presided over the day-long affair held in the MCZ Library. The morning was devoted to a slide presentation of paper's historical development, featuring such items as 18th Century naturalist Réaumer's proposal that wasp nests be used as a raw material for the paper (cotton rags being scarce at the time).

In the afternoon session Friends learned how to pull

How paper is made is the subject under earnest consideration by (clockwise) Bob Hauser (standing), Henry Rugo, Christian Verbeke, Peter Strong, Jody Klein, Bonnie Lucas, and Gloria Jaffe.

a paper mould from a vat of pulp, remove the deckle from the mould, felt press, and screen dry the newly-made paper.

Other programs in this Spring's *Basics for Bibliophiles* program have included: Care of Leather Bindings (April 10) with Mary Keeler of the MCZ Library; How to Care for Works of Art on Paper (May 1) with Marjorie Cohn of the Fogg Art Museum's Conservation Department; and Decorative Papermaking (May 15) with Sam Ellenport of the Harcourt Bindery.



BARBARA LAWRENCE, CURATOR OF MAMMALS, TO RETIRE

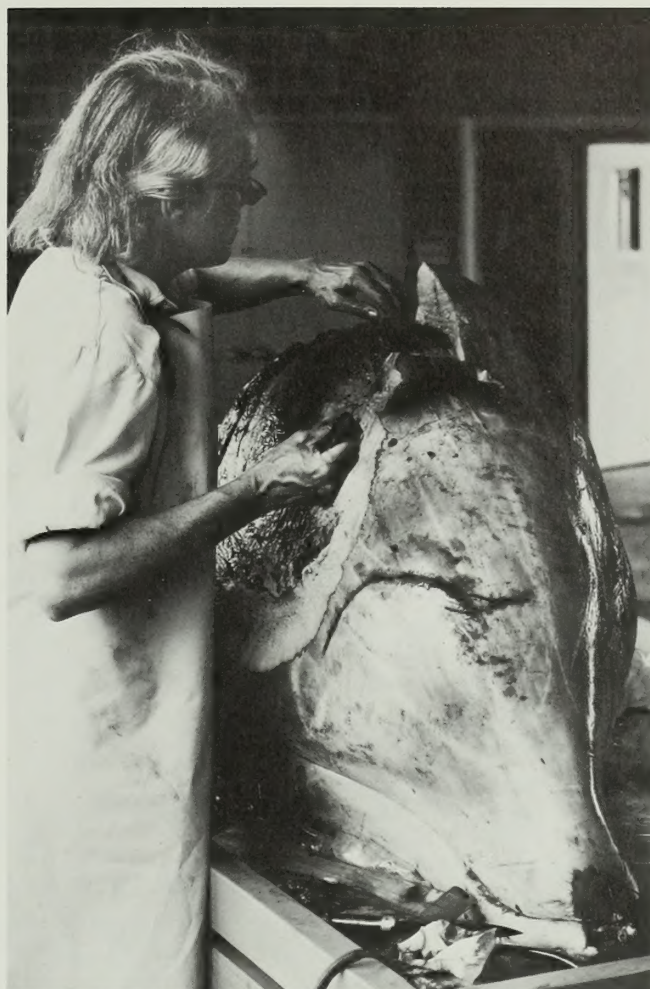
When Barbara Lawrence retires on August 31, 1976, she will have served the MCZ in various capacities for over 45 years. When she first arrived from Vassar College in 1931, Thomas Barbour was Director and G.M. Allen was Curator of Mammals. Upon the death of the latter in 1942, Miss Lawrence was promoted from Assistant Curator to Associate and Acting Curator. In 1952 she became Curator and in that capacity has continued to take care of the mammal collection and pursue her research to the present.

Her research work can be divided into three periods. She started out working on the systematics of the collections, particularly of bats and rodents. She helped expand the MCZ's holdings through various collecting trips, notably to the Philippines and Dutch East Indies. In the early 1950's, in conjunction with William E. Schevill, her attention focused on the largest of the mammals — whales. The question of how they produced sounds underwater without releasing air led to a series of dissections on the nose and throat of cetaceans and related studies on live animals.

Of the miscellaneous activities associated with the Mammal Department, identification of bones for archeologists became increasingly time consuming during this period. At a formal meeting arranged by the National Academy of Sciences the question of how to deal with remains from archeological digs that were not artifacts was addressed for the first time with Miss Lawrence serving as "bone person". This was the beginning of faunal archeology in this country and, to quote her, "as the dripping of water weareth away stone" this field has now achieved respectability, "a trade that people get hired to practice". Obviously this is a significant trade since knowledge of an early culture can't be learned from just tools and pots. Miss Lawrence's work on the early domestication of dogs grew out of her work with archeological expeditions.

In the late 60's, this aspect of her research shifted to focus on relationships within the genus *Canis*. Together with W.H. Bossert, a series of studies were undertaken to test the usefulness of multivariate analysis in investigating possibly hybrid populations and to standardize data collecting and computing analysis to make it possible for researchers in the field to produce results which are truly comparable.

Miss Lawrence has been instrumental, together with Charles P. Lyman, Curator of Mammals, in the evolution of the Mammal Department's emphasis from straight systematics to a more experimental approach. According to Miss Lawrence, "The questions 'what' and 'when' were replaced by 'how' and 'why' ". The establishment of the Concord Field Sta-



*Miss Barbara Lawrence actively studying the anatomy of the head of a *Ziphius* whale, 1961.*

tion in 1968 to hold live animals and provide facilities for studying behavior, functional morphology, and physiology was a vital step in this direction.

When asked what she plans to do now, Miss Lawrence's immediate response was, "Quit as quick as I can — been working overtime for too darn long!" Actually before she retires she plans to clean out the remaining departmental "glory holes", so named by Thomas Barbour and consisting of cupboards of unprocessed material. "Barbour's hand was deep in his pocket to get on with this work", Miss Lawrence explains and it was in this capacity that she started her career here. Since the Mammal Department has not had sufficient staff to deal with the abundant finds of early collecting trips, some materials from 1937 are still in "temporary storage". Miss Lawrence feels a commitment to complete this task as she is the only one who can really do it. "An awful lot is only in my head", she explains, "I know the collector's handwriting and the locality information from correspondence". She plans to leave the Department well organized for Edith Rutzmoser, Curatorial Associate, who is assuming an increasing responsibility for the daily functioning of the Mammal Department.



FROM THE FIELD STATION

By William K. Newbury

How many of you still have in the back closet a carefully mounted insect collection from summer camp? Have you ever pulled a dusty book off the shelf only to spill out those brightly colored maple leaves you tried to press years ago?

These forgotten collections represent our attempts to satisfy our curiosity about the natural history of plants and animals. The study of nature, however, with its need for patient and detailed observation is often difficult to sustain. Just as we begin to develop a good set of records or a complete collection we get diverted by other demands on our time. Also this study by focusing on one group such as insects or leaves often seems an isolated and remote aspect of the natural world around us.

It has not always been this way. In earlier times one's livelihood was closely tied to his understanding of nature. The colonial farmers relied on their observations of the weather to guide their planting schedules and their knowledge of trees to select the best species for heating and the best for making tools. In the 19th century a large proportion of doctors were also excellent botanists because many of their cures were tied to the medicinal qualities of particular plants.

During this century our lives have drifted away from a close association with nature. We have emphasized technological solutions to problems and substituted artificial materials for natural ones. For most of us observation and appreciation of nature has become a peripheral aspect of our daily lives.

More recently, however, the emergence of ecology and environmental concerns has added a new dimension to our appreciation of nature. Relationships and relevance to man have become all important. We have been bombarded with pictures of fish kills in polluted streams and broken egg shells of birds with high levels of DDT. Food chains, eutrophication and endangered species are now part of the common vernacular.

With this increased attention to ecological relationships, the importance of accurate natural history data has also increased. Detailed information on individual organisms and their environments is essential both to test the validity of the ecological principles themselves and to make sure they are applicable to particular situations.

As the information has become more important, there has been a renewed interest at all levels in natural history. This past fall at our open house we included exhibits of local plants, insects, birds and mammals, and we were swamped with visitors and a

never-ending barrage of questions. Similarly, our courses on small mammals and wildflowers have always been fully subscribed with both adults and teenagers.

The undergraduates who have come to the Field Station on field trips are just as eager to learn about the natural history of the forest as they are to test out the ecological principles they are studying in class. Also this spring we have had ten groups of elementary students and two high school classes combing the ponds, fields and woodlands of the Field Station on various projects.

In an effort to aid those people who want to explore on their own, we have published this spring a tree identification booklet entitled *Concord Area Trees*. Ray Angelo, a Bedford resident who wrote the guide entirely on his own initiative, used the 100 trees listed in Richard Eaton's *Flora of Concord* as the starting point for his work. Filled with detailed illustrations of leaf and fruit characteristics, the booklet is an extremely valuable guide for those who want to learn more about the natural world around them.

THANK YOU!

Peter Walsh, Carla Gordon, David Ebert, Lula Christopher, and Kate Walton wish to thank all those people, too numerous to list here, who contributed time, talent, specimens, and artifacts to the school education program this year. The generous cooperation of so many Museum staff members has been vital to the success of this year's Museum program (funded by the State Board of Education) for classes from the Boston schools.

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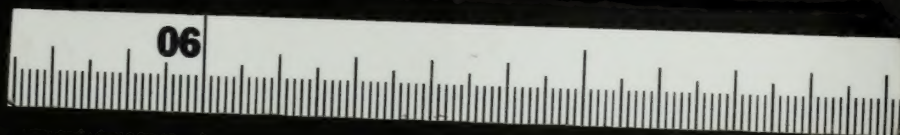
Photographers: A. H. Coleman

Paula Chandoha



Photo by Kenneth Miyata

Provincetown trophy – one of two humpback whales repeatedly sighted by Friends on the whale-watching trip on May 1.



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